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R&D Planning System Approach at Organizational Level

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Abstract

Planning of research and development (further R&D) requires a separate analysis and research because of the specificity of this activity comparing with the ordinary organization activity and the output created. Therefore the main purpose of this paper is to present an R&D planning system approach at research organization, considering the peculiarities of R&D activity. It has been modelled after the analysis of the existing planning methodologies, the identification of the main stages of the planning process and by the formation of R&D process and output planning features. The system presents the main areas of R&D performance planning, considering different types of R&D.

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Keywords: R&D planning; Planning system; R&D activity; R&D process; R&D organization.

Introduction

All organizations are established in order to carry out their core business activity, i.e., to transform certain resources into certain products. This process must be managed – turned towards the desired direction therefore a planning function here plays a significant role. Different authors (Delmar & Shane, 2003; Nicholson & Possingham, 2006; Bottrill & Pressey, 2012; Chadwick, 2013; etc.) have widely analysed the importance of planning process, its system complexity and components role in the assessment of organization activity. However, R&D planning requires a separate analysis and research because of the specificity of this activity comparing with the ordinary organization activity and the output created. One of the major features distinguishing R&D is an uncertainty and spontaneity of R&D results, a requirement and problematic of R&D production quality determination. Also there has to be highlighted the exclusivity of R&D process, when researcher itself or a group of them is solely responsible

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for all process and the quality of the final product. There is also a limited possibility of this activity standardization in order to ensure an appropriate fluency of the product creation process or quality of the created production. Therefore the main ***purpose*** of this paper is to present an R&D planning system approach at research organization, considering the peculiarities of R&D activity.

To reach the defined goal there are a few ***methods*** used within the theoretical research. First of them is a comparative analysis of scientific literature in pursuance to highlight the peculiarities of R&D process and output, to define the existing planning methodologies and to analyse the possibilities to adopt one of them for R&D planning system. In this part the R&D planning is analysed on the ground of the key elements of the planning process which are critically important to adjust for R&D activity. The second part of theoretical research presents a modelled simplified R&D planning system by incorporating the chosen elements from the first part of the research.

1. Theoretical rationale of R&D planning system formation

In order to define a concept of R&D planning, it is necessary, first of all, to understand the essence of R&D and its types. Frascati Manual (2002) defines R&D as a systematic creative work of cognition, including the cognition of humans, culture and society, and the exploitation of the newly obtained results. R&D covers three main areas of activity: fundamental research, applied research and experimental development. Fundamental research is carried out primarily to acquire new knowledge about the essence of phenomena and facts that are investigated without any particular application or visualization. Applied research and experimental development, in turn, have a specific practical purpose. These R&D parts are important in order to develop R&D planning system, as different type of R&D activity requires different resources and leads to the different type of output and outcome. Therefore R&D type has to be considered when describing the key performance indicators (further KPI).

A rapid increase in the demand for R&D has blossomed research centres of different type and nature: Research Technology Organisations, Technology Transfer Centres, Joint Research Centres, Research and Innovation Centres, Competence Centres and others (all these organizational forms will be referred to in this paper as "research organizations"). National Research Council (2012) distinguishes four types of research organization (Academic, Industrial, Mission driven and Product driven), which differ in their activity perspectives. Griffin & Page (1996) propose three possible research organization's activity perspectives depending on the level of innovativeness. Authors distinguish three possible strategic conditions: less innovative, medium innovative and innovative strategy. Other authors (Ojanen & Vuola, 2003; Leitner & Warden, 2004; Vijayalakshmi & Iyer, 2011) also put the overall performance strategy as the front dimmension of R&D activity structure while analysing the assessment system of research organization through the measurement of achieved goals. According to Chadwick (2013), because the real world is constantly changing, planning must be concerned with the continual change and the goals of planning have to change with time. In this way, it is obvious that different scientific institutions today have different visions or different strategic goals, so both short-term and long-term R&D planning should be based on the clear composition of activity by the different types of R&D in order to allocate the limited resources more efficiently.

One more important aspect of R&D is uncertainty and spontaneity of its results. As one of the main goals of R&D activity is to deepen the theoretical or practical knowledge in research, the final successful result is never assured. If one of ISO 9000 principles is to ensure the precisely defined and consistent processes in order to meet the standard of the activity, in case of R&D activity, it neither can be standardised because of the unpredictability of the process, nor can the concrete final results be described.

Therefore while planning the KPI of R&D activity, it is important to keep in mind that it is impossible to predict precisely the target production level and quantify it accurately. However this does not decrease the role and significance of planning in the R&D process. Here the primary principle is diverted from the search of specific measurable performance parameters to identification of this activity direction and orientation seeking for rational utilization of limited resources. Valentinavicius (2011) confirms that there is no consensus on the specification degree of R&D formal planning and it is suggested to treat an R&D strategy as a process structuring tool in making and implementing the decisions and not as strictly regulated, restrictive system.

In the world's practice there are mainly three planning methodologies used: formal planning, limited rationality and systematic planning. Considering the peculiarities of R&D activity, here it is appropriate to adapt a systematic planning methodology, which sees the emerged problems as a dynamic and constantly changing over time, therefore

it is difficult to define them in a long-term. Systematic planning extends the sphere of research, enables to use methods of different reflections and to solve problems in more realistic way despite the lack of precision as in other two methodologies.

To sum up with the specific of R&D activity and considering a content of the systematic planning, the following key elements can be listed that need to be considered on the R&D planning approach modeling:

- dynamic and constantly changing R&D environment;
- research organizations with different perspectives and missions;
- uncertainty and spontaneity of R&D results;
- R&D types with different forms of output and outcome.

There is an evident lack of theoretical and empirical studies analysing the specificity of R&D planning, as the existing literature offen focuses only on the technological activity planning. The differences of R&D outputs are emphasized by Choi et al. (2012). They present a model for supporting research planning which is composed of R&D planning activities, R&D planning support services, and three different types of outcome analysis tools. But their model does not distinguish between "R&D output" and "R&D outcomes", and puts only a paper, patent and R&D report as the different type of production, considering them as "outcomes".

2. Research results and analysis

Figure 1 presents a simplified R&D planning system aproach. It mainly focusses on the separate blocks which has to be considered through the systematic planning. The main separate areas are distinguished according to the R&D activity structure. The scientists (Coccia, 2001, 2005; Ojanen&Vuola, 2003; Cincera et al., 2008; Paul et al., 2010) propose the R&D conceptual structure with three main components: Inputs, Outputs and Outcomes. Thus, it can be assumed that this sequence is the basis of R&D activity concept which divides the system into two different processes: R&D process (where the different kind of resources (Inputs, e.g. materials, knowledge, funds) are transformed to the products (Outputs) during the scientific activity) and Transfer system (where the R&D products (Outputs) are spread into the environment of the research organization). The basic conceptual structure of R&D activity allows to identify the key processes of R&D activity and to describe the main logic how the R&D planning system approach is constructed.

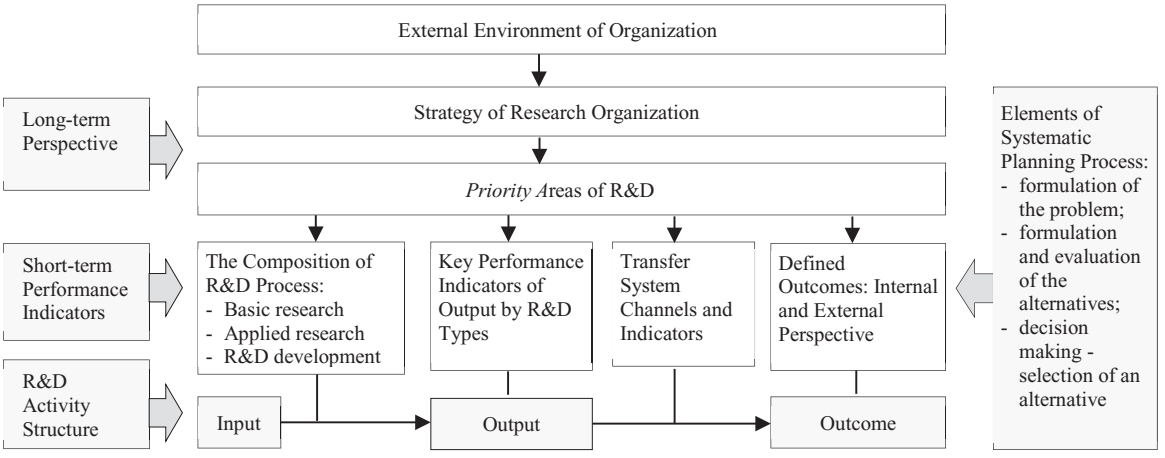

Fig. 1. Simplified R&D Planning System Aproach for Research Organization

Starting with the long-term perspective, a Strategy of Research Organization has to be set up. In order to successfully provide an R&D orientation and assess the organization's ability to meet them, there are two

performance analysis perspectives distinguished. The first perspective "from above", which evaluates the global R&D trends, perspectives, research demand in a particular research areas, the priority directions of country's R&D activities and opportunities to contribute to their performance or development, as well as the country's economic and cultural capacities. In this way, it is intended to identify the specifics of the organization, its identity, define business vision, mission and strategic goals, and clearly identify the direction between the two extremes - research vs. production lots. In order to successfully provide activity profile, it is not enough to identify a vision or aspirations, it is also important to assess the organization's ability to carry out the relevant type of research. Identification of Research organizations opportunities in the aspect of R&D type research is defined as a perspective “from the bottom”. The analysis of possibilities includes two aspects: an assessment of the researchers' scientific competence and analysis of the existing or potential possibilities to acquire industrial and technological capacity.

Depending on the strategy that has been set, the Innovation oriented research organizations will compose their KPI concentrating more on the applied research or R&D development and their output. While academic research organizations will concentrate their activity on basic or applied research and will set the KPI for more scientific outputs.

Nowadays, research organizations should care not just about the proper quality of research output, but also about how to spread those scientific results to its environment. The efficiency of this a Transfer system might depend on a succesfull planning of transfer activities. There could be a few different transfer links to the organizations environment seted: science to science; science to bussiness; science to society. The consideration of transfer area would lead to more effective use of R&D and would encourage to create the right plathform for the R&D results spread.

The last area of R&D planning system is an Outcome definition. In the most general sense, there can be distinguished two major directions of R&D benefit: that is the benefit for R&D operating organization or the benefit for its environment (for organizations, companies or society outside research company). The internal perspective of outcome could be expresed in to the financial and non-financial outcomes, while the external perspective can have the wider range of time and type of indicator depending on who is a recipient.

Conclusions

The paper presents R&D planning system which covers the main areas of R&D goal setting considering different types of R&D organizations and the composition of activity. It is modelled in accordance of the indicated peculiarities of R&D activity:

- generally it is hardly possible to plan a specific (measurable) R&D results because of the R&D activity’s spontaneity and the results’ uncertainty. There are planned and identified only the priority research areas of R&D;
- the researcher himself is responsible for the expected performance results and their quality to a large extent, because he is the main character, applying its internal scientific potential in the process of resources transformation to new knowledge, therefore it cannot be standardized;
- R&D types with different form of output and outcome;
- Research organizations with different perspective and mission.

The exact composition of KPI according to the different type of R&D is driven by the overall strategy of R&D organization which is also determined according to the environment of organization. There are 4 separate areas of planning within the R&D activity: (i) R&D process with the clear vision about the scopes of each type of R&D activity; (ii) R&D output block where all the possible R&D production vary from the scientific to the developed product; (iii) Transfer block, where all the channels and links have to be planed and defined; (iiii) R&D outcome with all the range of R&D results to the company itself and to its environment.

The ***theoretical contribution*** of this paper gives a new systematic approach to the planning of specific - R&D - area, which is an important part for economic and social development of any country. A ***practical implication*** of this research is also significant, as the global changes in the modern world, together with the rapid scientific and technical progress and strict competition forces the organizations to develop R&D field. The presented R&D

planning system approach will lead to more effective management of research organizations in order to direct the whole activity and to concentrate the limited resources and efforts for more effective their usage. Accordingly a proper R&D planning will lead to more accurate research organizations' activity evaluation, as it is usually based on the assessment of the degree of organization's purpose implementation or realization of the set goals.

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